REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Changes to error tests in table I. Update document. Editorial changes throughout.	93-02-09	K. A. Cottongim

REV																				
SHEET																				
REV																				
SHEET																				

REV STATUS OF SHEETS															
REV	A	A	A	A	A	A	A	A	A	A	A	A		
SHEET	1	2	3	4	5	6	7	8	9	10	11	12		

PMIC N/A

STANDARDIZED MILITARY DRAWING

THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE

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DRAWING APPROVAL DATE
91-09-05

REVISION LEVEL
A

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

MICROCIRCUIT, LINEAR, 12-BIT, D/A CONVERTER, HYBRID

SIZE	CAGE CODE	
A	67268	5962-90570

SHEET 1 OF 12

DESC FORM 193
JUL 91

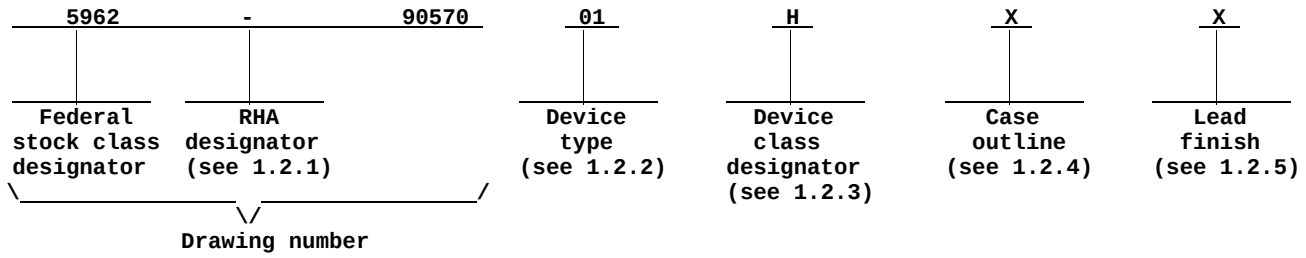
5962-E109-93

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

1. SCOPE

1.1 Scope. This drawing forms a part of a one part - one part number documentation system (see 6.6 herein). This drawing describes device requirements for hybrid microcircuits to be processed in accordance with MIL-H-38534. Two product assurance classes, military high reliability (device class H) and space application (device class K) and a choice of case outlines and lead finishes are available and are reflected in the Part or Identifying Number (PIN). When available, a choice of radiation hardness assurance levels are reflected in the PIN.

1.2 PIN. The PIN shall be as shown in the following example:



1.2.1 Radiation hardness assurance (RHA) designator. Device classes H and K RHA marked devices shall meet the MIL-H-38534 specified RHA levels and shall be marked with the appropriate RHA designator. A dash (-) indicates a non-RHA device.

1.2.2 Device type(s). The device type(s) shall identify the circuit function as follows:

Device type	Generic number	Circuit function
01	MN3860	12-bit D/A converter with input register

1.2.3 Device class designator. This device class designator shall be a single letter identifying the product assurance level as follows:

Device class	Device requirements documentation
H or K	Certification and qualification to MIL-H-38534

1.2.4 Case outline(s). The case outline(s) shall be as designated in MIL-STD-1835 and as follows:

Outline letter	Descriptive designator	Terminals	Package style
X	See figure 1	24	Dual-in-line

1.2.5 Lead finish. The lead finish shall be as specified in MIL-H-38534 for classes H and K. Finish letter "X" shall not be marked on the microcircuit or its packaging. The "X" designation is for use in specifications when lead finishes A, B, and C are considered acceptable and interchangeable without preference.

1.3 Absolute maximum ratings. 1/

Positive supply voltage range ($+V_{CC}$)	-0.5 V dc to +18 V dc
Negative supply voltage range ($-V_{CC}$)	+0.5 V dc to -18 V dc
Logic supply voltage range (V_{DD})	-0.5 V dc to +7 V dc
Digital input range	0.0 V dc to +5.5 V dc
Power dissipation (P_D)	730 mW
Thermal resistance, junction-to-case (θ_{JC})	12°C/W
Thermal resistance, junction-to-ambient (θ_{JA})	45°C/W
Lead temperature (soldering, 10 seconds)	+300 °C
Storage temperature range	-65°C to +150°C
Junction temperature (T_J)	+175°C

1.4 Recommended operating conditions.

Positive supply voltage range ($+V_{CC}$)	+14.55 V dc to +15.45 V dc
Negative supply voltage range ($-V_{CC}$)	-14.55 V dc to -15.45 V dc
Logic supply voltage range (V_{DD})	+4.75 V dc to +5.25 V DC
Ambient operating temperature range (T_A)	-55°C to +125°C

2. APPLICABLE DOCUMENTS

2.1 Government specification, standards, and handbook. Unless otherwise specified, the following specification, standards, and handbook of the issue listed in that issue of the Department of Defense Index of Specifications and Standards specified in the solicitation, form a part of this drawing to the extent specified herein.

SPECIFICATION

MILITARY

MIL-H-38534 - Hybrid Microcircuits, General Specification for.

STANDARDS

MILITARY

MIL-STD-480 - Configuration Control-Engineering Changes, Deviations and Waivers.
MIL-STD-883 - Test Methods and Procedures for Microelectronics.
MIL-STD-1835 - Microcircuit Case Outlines.

HANDBOOK

MILITARY

MIL-HDBK-780 - Standardized Military Drawings.

(Copies of the specification, standards, and handbook required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Order of precedence. In the event of a conflict between the text of this drawing and the references cited herein, the text of this drawing shall take precedence.

1/ Stresses above the absolute maximum rating may cause permanent damage to the device. Extended operation at the maximum levels may degrade performance and affect reliability.

3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with MIL-H-38534 and as specified herein.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-H-38534 and herein.

3.2.1 Case outline(s). The case outline(s) shall be in accordance with 1.2.4 herein and figure 1.

3.2.2 Terminal connections. The terminal connections shall be as specified on figure 2.

3.2.3 Logic coding. The logic coding shall be as specified on figure 3.

3.2.4 Timing diagram. The timing diagram shall be as specified on figure 4.

3.2.5 Output voltage connection. The output voltage diagram shall be as specified on figure 5.

3.3 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in table I and shall apply over the full specified operating temperature range.

3.4 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table II. The electrical tests for each subgroup are described in table I.

3.5 Marking. Marking shall be in accordance with MIL-H-38534. The part shall be marked with the PIN listed in 1.2 herein. In addition, the manufacturer's PIN may also be marked as listed in QML-38534.

3.6 Manufacturer eligibility. In addition to the general requirements of MIL-H-38534, the manufacturer of the part described herein shall maintain the electrical test data (variables format) from the initial quality conformance inspection group A lot sample, produced on the certified line, for each device type listed herein. The data should also include a summary of all parameters manually tested, and for those which, if any, are guaranteed. This data shall be maintained under document revision level control by the manufacturer and be made available to the preparing activity (DESC-EC) upon request.

3.7 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to supply to this drawing. The certificate of compliance submitted to DESC-EC shall affirm that the manufacturer's product meets the requirements of MIL-H-38534 and the requirements herein.

3.8 Certificate of conformance. A certificate of conformance as required in MIL-H-38534 shall be provided with each lot of microcircuits delivered to this drawing.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-H-38534.

4.2 Screening. Screening shall be in accordance with MIL-H-38534. The following additional criteria shall apply:

a. Burn-in test, method 1015 of MIL-STD-883.

(1) Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to either DESC-EC or the acquiring activity upon request. Also, the test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1015 of MIL-STD-883.

(2) T_A as specified in accordance with table I of method 1015 of MIL-STD-883.

b. Interim and final electrical test parameters shall be as specified in table II herein, except interim electrical parameter tests prior to burn-in are optional at the discretion of the manufacturer.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions $-55°C \le T_A \le +125°C$ $\pm V_{CC}$ = ±15 V dc, V_{DD} +5 V dc unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Digital input logic levels	V_{IH}	For all digital inputs	1,2,3	01	+2.0		V
	V_{IL}					+0.7	
Digital input currents	I_{IH}	V_{IH} = +2.4 V	1,2,3	01		+30	µA
	I_{IL}	V_{IL} = +0.4 V	1,2,3	01	-0.6		mA
Register enable input currents	I_{IH}	V_{IH} = +2.4 V	1,2,3	01		+60	µA
	I_{IL}	V_{IL} = +0.4 V	1,2,3	01	-1.2		mA
Power supply drain currents	$+I_{CC}$	$+V_{CC}$ = +15.5 V	1,2,3	01		+12	mA
	$-I_{CC}$	$-V_{CC}$ = -15.5 V	1,2,3	01	-20		
	I_{DD}	V_{DD} = +5.25 V	1,2,3	01		+50	
Power consumption	P_D		1,2,3	01		730	mW
Power supply rejection ratio	+PSRR	$+14.5\ V \le +V_{CC} \le +15.5\ V$	1,2,3	01	-0.04	+0.04	%FSR/ $\%V_S$
	-PSRR	$-14.5\ V \le -V_{CC} \le -15.5\ V$	1,2,3	01	-0.004	+0.004	
Unipolar +FS error	UFSE	+10 V range Input code = 0000 0000 0000 T_A = +25°C	4	01	-0.1	+0.1	%FSR
Unipolar +FS error temperature coefficient	TCUFSE	+10 V range Input code = 0000 0000 0000 T_A = -55°C, +125°C	5,6	01	-0.3	+0.3	%FSR
Bipolar +FS error	BFSE	±10 V range Input code = 0000 0000 0000 T_A = +25°C	4	01	-0.1	+0.1	%FSR

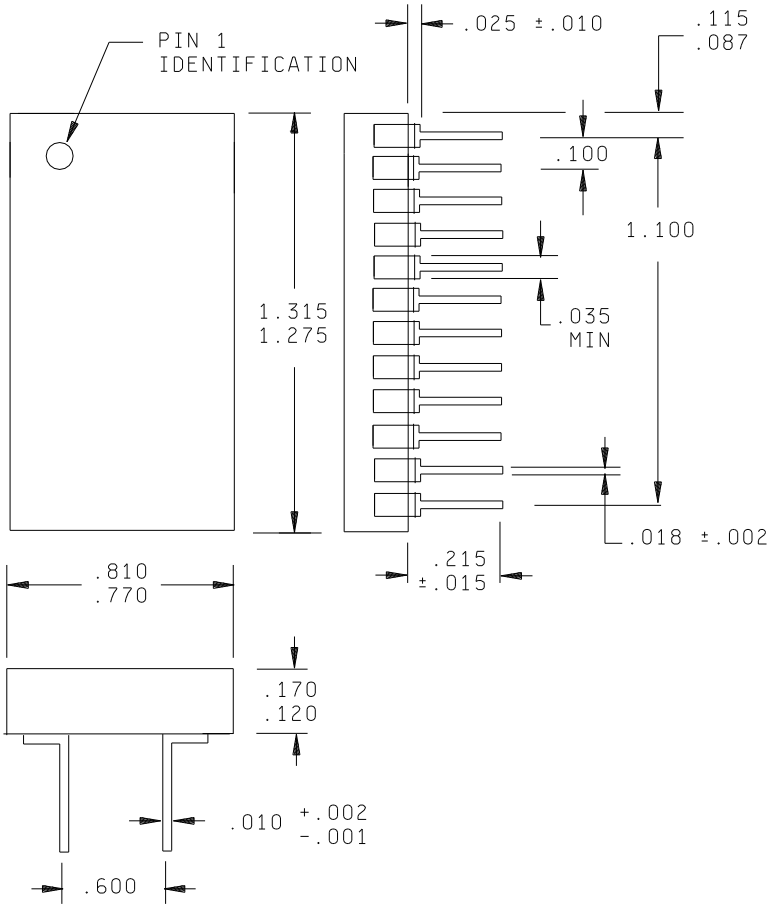
See footnote at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55°C \le T_A \le +125°C$ $\pm V_{CC}$ = ±15 V dc, V_{DD} +5 V dc unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Bipolar +FS error temperature coefficient	TCBFSE	±10 V range Input code = 0000 0000 0000 T_A = -55°C, +125°C	5,6	01	-0.3	+0.3	%FSR
Bipolar zero error	BZE	±10 V range Input code = 0111 1111 1111 T_A = +25°C	4	01	-0.05	+0.05	%FSR
Bipolar zero error temperature coefficient	TCBZE	±10 V range Input code = 0111 1111 1111 T_A = -55°C, +125°C	5,6	01	-0.1	+0.1	%FSR
Unipolar offset error	VOS	+10 V range Input code = 1111 1111 1111 T_A = +25°C	4	01	-0.05	+0.05	%FSR
Unipolar offset error temperature coefficient	TCVOS	+10 V range Input code = 1111 1111 1111 T_A = -55°C, +125°C	5,6	01	-0.1	+0.1	%FSR
Bipolar -FS error	BFSE	±10 V range Input code = 1111 1111 1111 T_A = +25°C	4	01	-0.1	+0.1	%FSR
Bipolar -FS error temperature coefficient	TCBFSE	±10 V range Input code = 1111 1111 1111 T_A = -55°C, +125°C	5,6	01	-0.3	+0.3	%FSR
Linearity error	LE		4,5,6	01	-0.5	+0.5	LSB
Output current	IO		4,5,6	01	-4.0		mA
Output settling time 1/	t_{OS}	To +0.01% for 20 V step See figure 4	9,10,11	01		7	µs
		To +0.01% for 10 V step See figure 4	9,10,11	01		5	µs

1/ Parameter shall be tested as part of device characterization and after design and process changes. Parameter shall be guaranteed to the limits specified in table I for all lots not specifically tested.

Case outline X



Inches	mm	Inches	mm
.001	0.03	.115	2.92
.002	0.05	.120	3.05
.005	0.13	.170	4.32
.010	0.25	.215	5.46
.015	0.38	.600	15.24
.018	0.46	.770	19.56
.025	0.63	.810	20.57
.035	0.89	1.100	27.94
.087	2.21	1.275	32.38
.100	2.54	1.315	33.40

NOTES:
1. **Dimensions are in inches.**
2. **Metric equivalents are given for general information only.**
3. **Unless otherwise specified, tolerances are ±.005.**

FIGURE 1. Case outline.

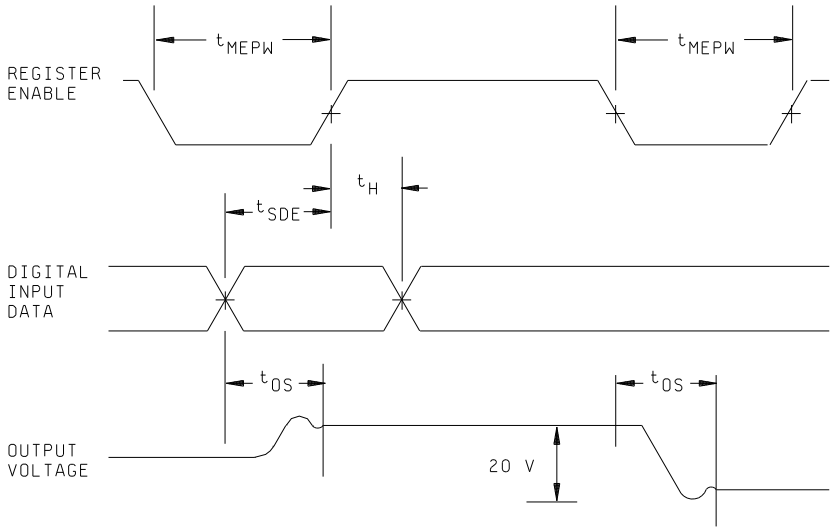
Device type	01
Case outline	X
Terminal number	Terminal symbol
1	Bit 1 (MSB)
2	Bit 2
3	Bit 3
4	Bit 4
5	Bit 5
6	Bit 6
7	Bit 7
8	Bit 8
9	Bit 9
10	Bit 10
11	Bit 11
12	Bit 12 (LSB)
13	V_{DD}
14	$-V_{CC}$
15	Analog output
16	Reference input
17	Bipolar offset
18	10 V range
19	Register enable
20	Summing junction
21	Ground
22	$+V_{CC}$
23	Zero (-FS) adjust
24	Reference output

FIGURE 2. Terminal connections.

Digital input	Analog output		
MSB LSB	0 to +10 V	±5 V	±10 V
0000 0000 0000	+9.9976 V	+4.9976 V	+9.9951 V
0000 0000 0001	+9.9951 V	+4.9951 V	+9.9902 V
0111 1111 1111	+5.0000 V	0.0000 V	0.0000 V
1000 0000 0000	+4.9976 V	-0.0024 V	-0.0049 V
1111 1111 1110	+0.0024 V	-4.9976 V	-9.9951 V
1111 1111 1111	0.0000 V	-5.0000 V	-10.0000 V

NOTES:
1. For unipolar operation, the coding is complementary straight binary (CSB).
2. For binary operation, the coding is complementary offset binary (COB).
3. For FSR = 20 V, 1 LSB = 4.88 mV.
4. For FSR = 10 V, 1 LSB = 2.44 mV.

FIGURE 3. Logic coding.



NOTES:
1. **Minimum enable pulse width (t_{MEPW}) is 60 ns.**
2. **Minimum setup time digital input data to enable (t_{SDE}) is 40 ns.**
3. **Hold time (t_H) is defined as the required delay between leading edge of register enable and the end of valid input data. For device type 01, hold time is 0 ns.**
4. **Output settling time (t_{OS}) for 20-volt change to ±1/2 LSB is 7 µs maximum.**

FIGURE 4. Timing diagram.

Pin connections	0 to +10 V	±5 V	±10 V
Pin 24 to	16	16	16
Pin 17 to	21	20	20
Pin 15 to	18	18	NC
Pin 20 to	NC	17	17

NOTE: NC = no connection.

FIGURE 5. Output voltage connections.

TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (in accordance with method 5008, group A test table)
Interim electrical parameters	
Final electrical test parameters	1*,2,3,4,5,6,9
Group A test requirements	1,2,3,4,5,6,9,10,11
Group C end-point electrical parameters	1,2,3
Group E end-point electrical parameters for RHA devices	Subgroups ** (in accordance with method 5005, group A test table)

* PDA applies to subgroup 1.
** When applicable to this standardized military drawing, the subgroups shall be defined.

4.3 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-H-38534 and as specified herein.

4.3.1 Group A inspection. Group A inspection shall be in accordance with MIL-H-38534 and as follows:

a. Tests shall be as specified in table II herein.

b. Subgroups 7 and 8 shall be omitted.

4.3.2 Group B inspection. Group B inspection shall be in accordance with MIL-H-38534.

4.3.3 Group C inspection. Group C inspection shall be in accordance with MIL-H-38534 and as follows:

a. End-point electrical parameters shall be as specified in table II herein.

b. Steady-state life test, method 1005 of MIL-STD-883.

(1) Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to either DESC-EC or the acquiring activity upon request. Also, the test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1005 of MIL-STD-883.

(2) T_A as specified in accordance with table I of method 1005 of MIL-STD-883.

(3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

4.3.4 Group D inspection. Group D inspection shall be in accordance with MIL-H-38534.

4.3.5 Group E inspection. Group E inspection is required only for parts intended to be marked as radiation hardness assured (see 3.5 herein). RHA levels for device classes H and K shall be M, D, R, and H. RHA quality conformance inspection sample tests shall be performed at the RHA level specified in the acquisition document.

a. RHA tests for device classes H and K for levels M, D, R, and H shall be performed through each level to determine at what levels the devices meet the RHA requirements. These RHA tests shall be performed for initial qualification and after design or process changes which may affect the RHA performance of the device.

b. End-point electrical parameters shall be as specified in table II herein.

c. Prior to total dose irradiation, each selected sample shall be assembled in its qualified package. It shall pass the specified group A electrical parameters in table I for subgroups specified in table II herein.

d. For device classes H and K, the devices shall be subjected to radiation hardness assured tests as specified in MIL-H-38534 for RHA level being tested, and meet the postirradiation end-point electrical parameter limits as defined in table I at T_A = +25°C ±5 percent, after exposure.

e. Prior to and during total dose irradiation testing, the devices shall be biased to establish a worst case condition as specified in the radiation exposure circuit.

f. For device classes H and K, subgroups 1 and 2 in table V, method 5005 of MIL-STD-883 shall be tested as appropriate for device construction.

g. When specified in the purchase order or contract, a copy of the RHA delta limits shall be supplied.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-H-38534.

6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for use for Government microcircuit applications (original equipment), design applications, and logistics purposes.

6.2 Replaceability. Microcircuits covered by this drawing will replace the same generic device covered by a contractor-prepared specification or drawing.

6.3 Configuration control of SMD's. All proposed changes to existing SMD's will be coordinated with the users of record for the individual documents. This coordination will be accomplished in accordance with MIL-STD-481 using DD Form 1693, Engineering Change Proposal (Short Form).

6.4 Record of users. Military and industrial users shall inform Defense Electronics Supply Center when a system application requires configuration control and the applicable SMD. DESC will maintain a record of users and this list will be used for coordination and distribution of changes to the drawings. Users of drawings covering microelectronic devices (FSC 5962) should contact DESC-EC, telephone (513) 296-6047.

6.5 Comments. Comments on this drawing should be directed to DESC-EC, Dayton, Ohio 45444, or telephone (513) 296-5373.

6.6 One part - one part number system. The one part - one part number system described below has been developed to allow for transitions between identical generic devices covered by the four major microcircuit requirements documents (MIL-M-38510, MIL-H-38534, MIL-I-38535, and 1.2.1 of MIL-STD-883) without the necessity for the generation of unique PIN's. The four military requirements documents represent different class levels, and previously when a device manufacturer upgraded military product from one class level to another, the benefits of the upgraded product were unavailable to the Original Equipment Manufacturer (OEM), that was contractually locked into the original unique PIN. By establishing a one part number system covering all four documents, the OEM can acquire to the highest class level available for a given generic device to meet system needs without modifying the original contract parts selection criteria.

Military documentation format	Example PIN under new system	Manufacturing source listing	Document listing
New MIL-M-38510 Military Detail Specifications (in the SMD format)	5962-XXXXXZZ(B or S)YY	QPL-38510 (Part 1 or 2)	MIL-BUL-103
New MIL-H-38534 Standardized Military Drawings	5962-XXXXXZZ(H or K)YY	QML-38534	MIL-BUL-103
New MIL-I-38535 Standardized Military Drawings	5962-XXXXXZZ(Q or V)YY	QML-38535	MIL-BUL-103
New 1.2.1 of MIL-STD-883 Standardized Military Drawings	5962-XXXXXZZ(M)YY	MIL-BUL-103	MIL-BUL-103

6.7 Sources of supply for device classes H and K. Sources of supply for device classes H and K are listed in QML-38534. The vendors listed in QML-38534 have submitted a certificate of compliance (see 3.7 herein) to DESC-EC and have agreed to this drawing.